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PNEUMATIC METHOD FOR CATCHING OR SCARING FISH

Melvin J. Wells, Torrance, Calif., assignor to Western Geophysical Company of America, Los Angeles, Calif., a corporation of Delaware

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8 Claims. (Cl. 43—4.5)

This is a division of application Serial Number 361,725, filed April 22, 1964, for Pneumatic Technique for Catching or Scaring Fish.

This invention relates to fishing techniques, and more particularly to the use of pneumatic devices for producing sound or shock waves and bubbles as an aid to fishing and related operations.

In the course of commercial fishing operations, particularly when purse seines are employed, it is customary to encircle a school of fish with a net and bring the edges of the net together to completely entrap the fish. However, in the course of closing the net, many of the fish frequently escape under the fishing vessel just as it is closing the loop. Alternatively, prior to drawing the bottom of the purse seine together the fish may escape through the final opening. In order to prevent the escape of fish, it has previously been customary to set off small explosive charges at a critical instant during the purse seine fishing cycle. The use of the small explosive charges has not proved to be entirely satisfactory as it is difficult to cause explosions at selected depths and as quickly as required to prevent the escape of fish. In addition, the use of explosives is dangerous, expensive, and there are many restrictions on the use and transportation of explosives which have been imposed by the Coast Guard and the harbor and port authorities.

Accordingly, an important object of the present invention is to improve purse seine fishing by the use of a reliable and easily controllable apparatus for producing shock waves under the surface of the ocean.

A broad object of the invention is to control movements of marine organisms by the simultaneous pneumatic operation of a sound device and the discharge of compressed air.

In accordance with the present invention, this object has been achieved through the use of one or more pneumatic sound wave production devices to assist in controlling or netting fish. These devices preferably produce a shock wave having a very high initial pressure peak. They may be operated from the conventional compressor tanks which are used for other purposes on commercial fishing vessels. Unlike explosives, there are virtually no Coast Guard or port authority restrictions on the use of pneumatic shock wave devices; furthermore, the pneumatic devices may be energized repeatedly during the critical stage of closing the purse seine, as contrasted with the problems involved in detonating successive charges of explosive material at the desired critical time and at the proper locations during the closing of the purse seine.

Pneumatic sources have the further advantage that in producing the sound a large amount of air is released into the water over a considerable area. The air breaks up into small bubbles and rises to the surface. The resultant "bubble curtain" acts as a barrier to further restrict the escape of fish past the device.

The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawings in which an illustrative embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention.

In the drawing:

FIG. 1 is a cross-sectional view of a pneumatic pressure device which may be employed in the implementation of the present invention.

FIG. 2 is a plot of pressure versus time as produced by the device of FIG. 1, and

FIGS. 3 and 4 show successive stages in the closing of a purse seine around a school of fish.

With reference to the drawings, the pneumatic device of FIG. 1 includes a source of high pressure compressed air **12**, an electrical control apparatus **14** and the pneumatic impulse generator **16**. The pneumatic device **16** includes upper and lower chambers **18** and **20**, respectively, and a multiple piston **22**. In operation, air under high pressure is supplied to the unit **16** through pneumatic tube **24** and, upon the energization of the triggering pneumatic tube **26**, the piston **22** with its upper and lower heads **28** and **30**, respectively, moves downward rapidly and explosively releases a sharp pressure impulse through the ports **32** which open into the water. This impulse is produced by the sudden venting of the high pressure chamber **18** into the water via holes **32**. With regard to operating details, the tube **26** is energized by the application of control signals from circuit **14** to the solenoid actuated valve **34**. In addition, the outer periphery of the lower piston head **30** is scalloped to permit its rapid descent once its movement is started.

As the piston **22** descends toward the end of its stroke, its forward motion is slowed and resiliently stopped by the water entrapped in the space **36** below the openings **32**. When the valve **34** is returned to its normal position, the pressure below piston face **30** is greater than that above piston **28** by virtue of the restriction **38** in the passageway **40**. The piston is therefore returned to its upper position, shown in FIG. 1, with the continuous lip **42** of the lower portion **30** of the piston engaging the resilient ring **44**. After the piston returns to the position shown in FIG. 1, the pressure in chamber **18** gradually builds up to the full pressure supplied by line **24** from the compressed gas source **12**. The upper position is stable because the upper surface of piston head **28** has less area than the lower area of piston head **30**. The unit is then ready for reactivation when the valve **34** is open, and the downward forces on piston heads **28** and **30** exceed the upward forces.

The shock wave unit **16** is designated unit A. A number of additional units **52** and **54**, which may also be designated as units B and C, respectively, may be energized from the source of compressed gas **12** and the electrical control circuitry **13**. With this arrangement, electrical switches are provided for individually controlling units A, B, and C, and they can be fired at virtually any desired time in accordance with needs as described below.

FIG. 2 shows output pressure underwater produced by a unit such as that shown in FIG. 1. The useful and unusual feature of the pneumatic shock wave device is well illustrated by the sharp initial pulse **56** which is produced as the piston descends and reaches an initial pressure peak within five milliseconds. The characteristic shown in FIG. 2 was taken underwater with a pressure sensing device. Peaks **58** and **60** resulted from cyclic collapse and expansion of the air bubble formed in the water as a result of the original air discharge.

FIGS. 3 and 4 illustrate the use of the pneumatic pressure shock wave system of the invention for fishing. In FIG. 3 a trawler **62** is shown with its purse seine net **64** encircling a school of fish **66**. At the lower edge of